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BARK ANALYSIS OF ATTACK AND EMERGENCE AND THE RELATION TO SUBSEQUENT INFESTATIONS.

STUDIES IN SOUTHERN OREGON.

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BARK ANALYSIS OF ATTACK AND EMERGENCE AND THE RELATION TO SUBSEQUENT INFESTATIONS.

The object of this study was to obtain quantitative data regarding the degree of attack upon living trees and the effective emergence of new beetles from these trees.

The immediate objective in presenting these analyses at the present time is to make available our quantitative data on Dendroctonus brevicomis attack and emergence in yellow pine.

The direct application of these data is to show the effective progeny which eventually develops from the parent beetles which attack the trees. When sufficient comprehensive records have been secured we may eventually be able to recognize what the comparative ratio between the number of beetles involved in attack and the number emerged from these attacks indicate and thereby predict with some degree of accuracy the effect upon the increase or decrease in infestations.

Inasmuch as Dendroctonus brevicomis is the most destructive primary insect in the western yellow pine forests today these preliminary studies were confined exclusively to this insect.

These records are based on the examination of one square foot of bark from each tree examined. In all a total of 1865 square feet of bark has been examined, representing an equal number of trees. In every case the trees examined had been attacked and killed by Dendroctonus brevicomis.

The points determined were limited to the count of:

1 - The number of entrance holes per sq, ft.

2 - The number of ventilation hloes per sq. ft.

3 - The number of exit holes per sq. ft.

The areas in which these records were secured are the Rogue River Area and the Jenny Creek Area; both in southern Oregon.

These areas were particularily suitable for the study inasmuch as we have continuous records of the annual loss by D. brevicomis on them for a number of years. For the Rogue River area our records of annual losses extend back to 1914 and on the Jenny Creek area to 1917. These records of annual loss show the relation between the number of beetles attacking, the number emerging, and the subsequent infestation.

Mr. Keen's statistics on the attack, mortality, and loss by D. brevicomis on the Lamb's Mine unit during the years 1915 and 1916 are taken as the basis or normal average in these studies. His figures giving

Attack per square foot 6.8
Parent adults attacking
per square foot 17.6
Ventilation holes per square foot ... 17.7
Emergence of new adults
per square foot ..... 80.

are used as the primary basis inasmuch as we have generally used these figures in slash and other similiar studies, involving these analyses.

Interpretation of these figures show that the ratio of attack to emergence is approximately as 1 to 4.5. That is, as an average basis, for every beetles that attacks 4.5 beetles emerge. Applying this ratio of emergence to attack and emergence for the various annual

infestations studied we get the results shown in the attached tables.

A list of parties contributing the data presented herewith includes the following:

Rogue River Area:

1915 and 1916 - F. P. Keen.
1916 and 1917 - J. M. Miller and W. E. Glendinning.
1918 and 1919 - W. E. Glendinning, P. D. Sergent and A. W. Wagner.
1920 to 1922 - P. D. Sergent and J. E. Patterson.

Jenny Creek Area:

1917 to 1922 - P. D. Sergent and J. E. Patterson.

In table I are shown the statistics for the Rogue River area since 1914. The first year for which we have statistics on bark analysis is 1915. The figures given for this year are Keen's for the Lamb's Mine unit. These are taken throughout the studies as the normal averages and all other like statistics are compared in ratio to them.

It will be noted under attack,(colums a and b), that there is very little variation in the number of beetles attacking per square foot of bark, regardless of the year of attack or the number of new adults emerged from these attacks or the status of the annual infestations. It would appear that this factor is fairly constant and that between 15 and 18 adults are required to successfully attack each square foot of bark of living trees. Likewise there is no great variation in the number of ventilitation holes per square foot, (colums c), although these are not entirely consistent with the number of adults attacking.

The greatest annual variation is shown in the number of new

adults emerged, (column d); the ratio of potential increase, based on a ratio of 1 to 4.5, (column e); the actual increase, (column f), and the percent of actual increase in the number of beetles attacking as compared to the normal increase of 62.4 beetles, (column g). All these statistics are closely interrelated and show the effective progeny of the number of beetles attacking 1 square foot of bark. The variation in number of beetles emerged ranges from 36 to 80.

The total annual loss and percent of stand killed on the Rogue River area for each year since 1914 are shown in columns h and i, respectively. It will be noted that these losses greatly fluctuate and that they do not bear a constant ratio to the number of adults emerged or the actual brood increase.

In column j is shown the increase or decrease percent in annual loss over the preceding year. These annual figures are comparable to those in column g showing the percent of normal broods emerged for that year although they do not bear a constant ratio.

The statistics given in table II for the Jenny Creek area are strikingly comparable to those in table I on the Rogue River area. In general the attacks and emergence per square foot run a trifle higher than those on the Rogue River area. However, the other statistics show about the same realtion.

A study of these tables will show that the prominent points brought out in the study are:

That attack and the number of parent adults attacking is fairly constant.

That the number of ventilation holes is fairly constant although not in direct ratio to the number of beetles attacking.

That there is a great variation in the number of new adults emerged and that the ratio of emergence to attack is not at all constant.

That the number of new adults emerged per sqaure foot of bark is not indicative of the amount of the subsequent infestation.

CONCLUSION:

It is evident that the data so far secured do not establish a sound basis for predicting future infestations from a count of attack and emergence in bark from abandoned trees. The determination of this point was the principal object of the study, but so far the results must be considered negative. Further studies may bring to light additional facts on this phase resulting in a dependable factor for this purpose.

The average for emergence which we have used in this and other studies is an arbitrary quantity and may be too high for a basic factor. I am inclined to believe that this is the case. In this and other studies 80 emerged beetles per square foot of bark has been taken as the basis whereas an average emergence for 8 years on the Rogue River area shows this avearge to be 52, and on the Jenny Creek area, for 6 years, 58. These latter figures are the averages for both endemic and epidemic infestations. The average on the Rogue River area for the three epidemic infestations which occurred in 1915, 1916, and 1918, show 64 emerged beetles per square foot. The average for the endemic infestations during the years 1917, 1919, 1920, 1921, and 1922 is 45 emerged beetles per square foot. This shows a difference of 19 beetles per square foot between epidemic and endemic conditions.

It is suggested that the records at the other stations be compiled with the view of obtaining a basic average for these events, both during epidemic and endemic infestations.

A large series of records from many localities are absolutely necessary to establish a reliable basis for predicting the character and amount of following infestations.

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TABLE I - BARK ANALYSIS AND ANNUAL LOSS ON THE ROGUE RIVER AREA:

Year	Analysis of 1 square foot of bark: Attack: Ent. holes (a)	No. adults (b)	Vent. holes (c)	Exit holes (d)	Potential increase (e)	Actual increase (f)	% of normal brood (g)	Total loss on Area: Volume in b.f. (h)	% of stand (i)	% of increase or decrease over previous year (j)
1914								346,390	.2%	
1915	6.8	17.6	17.7	80	80.2	62.4	100%	1,615,940	1. %	366%x
1916	6	15.5	16.4	65	69.8	49.5	80%	1,383,480	.9%	14.4%-
1917	6.5	16.8	10	50	75.6	33.2	53%	608,005	.4%	56%-
1918	6	15.5	12	47	69.8	31.5	50%	1,085,315	.7%	78%x
1919	5	13	13	40	58.5	27	43%	674,270	.45%	37%-
1920	7	18	16	36	81.	18	29%	462,050	.35%	31%-
1921	7	18	20	52	81.	34	56%	283,440	.18%	38%-
1922	7	18	14	45	81.	27	43%	390,050	.25%	40%x
1923								199,680	.13%	23%-
Average	6.4	16.7	15	52	75	35.3	37%			

TABLE II - BARK ANALYSIS AND ANNUAL LOSS ON THE JENNY CREEK AREA:

	Analysis of 1 square foot of bark							Total loss on area		
	Attack							Volume in	% of	% of increase or
	Entrance	Number	Vent.	Emergence	Potential	Actual	% of normal	board feet	stand	decrease over
Year	holes (a)	adults (b)	holes (c)	Exit holes (d)	increase (e)	increase (f)	brood (g)	(h)	(i)	preceding year (j)
1917	7	18	17.5	59	81	41	65%	335,000	.09%	
1918	8	20.7	19	71	93	50.3	80%	589,000	.16%	76%x
1919	7	18	18.5	60	81	42	67%	702,000	.19%	20%x
1920	6.5	16.8	17.5	51	75.6	34.2	55%	1,151,000	.32%	64%x
1921	7	18	16	50	81	32	51%	1,003,000	.3%	13%-
1922	7	18	18	58	81	40	64%	990,000	.27%	1%-
Average	6.8	19.4	17.7	58	87.3	38.6	62%			